

CLAIMS

1. Process for feeding powdered, granular or herb-based product to the dosing stations of compressing machines, capsule filling machines or packaging machines in general, operating on either a continuous or an alternating principle, in which the said product is placed in a loose state in a hopper (1) to whose lower part the said dosing stations (D) are connected, characterized in that the said hopper is pressurized internally with gas at a specified level of pressure, in such a way that the product contained therein is impelled by the said pressure of the gas towards the said dosing stations (D).
- 10 2. Process according to Claim 1, characterized in that the product hopper is pressurized internally with gas at constant levels of pressure, in such a way as to promote a constant dosing of the said product in the various dosing stations (D).
3. Process according to Claim 1, characterized in that the dosing stations (D) are designed to permit a controlled minimum discharge of gas towards the exterior, to promote the flow of the product from the pressurized hopper towards the stations.
- 15 4. Process according to Claim 3, characterized in that the dosing stations (D) discharge gas downwards, in such a way as to facilitate the subsequent removal of the small quantity of product which passes out together with the gas.
5. Process according to Claim 1, characterized in that the dosing stations (D) are 20 of the volumetric type and are designed to produce abrupt increases in the volumes of their dosing chambers, to create a cavitation effect which facilitates the flow of the product from the pressurized hopper towards the stations.
6. Process according to one or more of the preceding claims, characterized in that the product located in the hopper (1) is fluidized both by the gas used for the 25 internal pressurization of the said hopper and by the action of appropriate mechanical means designed for this purpose.
7. Process according to Claim 1, characterized in that the dosing stations (D) are designed for the application of suction (10) in their dosing chambers, to promote the flow of the product from the pressurized hopper towards the stations.

8. Process according to Claim 1, characterized in that the product hopper (1) is cyclically resupplied with a batch of product through a compensation chamber, located above the hopper, which is at atmospheric pressure when it receives the batch of product from feed means, and which is closed and pressurized to pressure levels at least equal to those of the hopper when the chamber is subsequently made to communicate with the said hopper for the transfer of the batch of product to the hopper.

5

9. Apparatus for feeding powdered, granular or herb-based product to the dosing stations (D) of compressing machines, capsule filling machines or packaging machines, in which the said product is placed in a loose state in a hopper (1), characterized in that it comprises means (6) connected to the inner part of the said hopper and connected externally to a source (7) which feeds gas at specified and preferably constant levels of pressure to the said hopper.

10

10. Apparatus according to Claim 9, characterized in that, if the product hopper (1) rotates about its own axis, the said hopper is provided axially with an upper aperture which is connected by means of a rotary joint (2) to a channel (3) for the cyclical feed of the product, which is supported by a fixed supporting frame (4) and intercepted by a normally closed valve (5), the channel (6) for the internal pressurization of the chamber being connected in the form of a branch to the portion of channel (3) lying

20

20. between the rotary joint (2) and the said valve (5).

11. Apparatus according to one or more of the preceding claims, characterized in that the channel (3) for feeding the product to the hopper (1) is connected to the lower outlet aperture of a compensation chamber (13) located above the hopper and having a volume suitable for containing the batch of product which has to be fed cyclically to the said hopper, the upper aperture of this chamber being connected, through a valve (14), to means (15) of feeding the product, and the said chamber being connected to a channel (18) which can be connected, through valve means (19 and 20), to an environment at atmospheric pressure or to a source (107) for delivering gas at pressure levels equal to or slightly greater than the internal pressures of the hopper (1), the whole being arranged in such a way that the

25

30

compensation chamber (13) can be brought to atmospheric pressure when the batch of product has been fed into it through its upper aperture opened by the corresponding valve (14), and means being provided to ensure that, on completion of the loading of the product, the upper valve (14) of the compensation chamber is

- 5 closed, the depressurization valve (20) is closed and the valve (19) connecting the compensation chamber to the pressurization source (107) is opened, means also being provided to ensure that, when the compensation chamber has been pressurized, the valve (5) connecting this chamber to the hopper (1) is opened, in such a way that the batch of product flows into the said hopper, means being
- 10 provided after this to ensure that this valve (5) is closed and the compensation chamber (13) is depressurized by the opening of the said valve (20) which preferably discharges through a filter (22) and/or other suitable means of recovering any small traces of product.

12. Apparatus according to Claim 11, characterized in that the means (15) of feeding the product to the compensation chamber (13) comprise a preparation chamber (15) which is located above the compensation chamber and which has a volume suitable for containing a batch of product, and which is connected at its top to means (17) of feeding the product and is provided, if required, with at least one sensor (16) for detecting the specified level of product in this chamber, the said feed means (17) being automatically stopped when this level is reached.

13. Apparatus according to the preceding claims, in which the compensation chamber (13) is of cylindrical shape with a round cross section, and has its lower flange (3) fixed to the upper aperture of the hopper (1) with the interposition of the rotary joint (2), this chamber being provided with an upper flange (213) fixed with a seal to the lower flange (115) of the preparation chamber (15) which is also of cylindrical shape with a round cross section, the suitably tapered lower apertures of the said chambers being closed by plugs (5, 14), of conical shape for example, integral with rods (105, 114), one of which is movable axially within the other, these rods having their upper ends integral with the pistons of respective cylinder and piston units (205, 214) whose cylinders are formed in a single casing having a

cylindrical outer shape with a round cross section, fixed coaxially in the preparation chamber (15), the said plugs being designed to open with a downward movement, in such a way that they are kept closed by the pressure of the gas in the chambers below them (1, 13).

- 5 14. Apparatus according to Claim 13, characterized in that the casing of the cylinder and piston units (205, 214) terminates in tapered conical upper end and this end can be separated from or can be fixed to a top cover (215) of the preparation chamber (15).
- 10 15. Apparatus according to Claim 13, characterized in that the casing of the cylinder and piston units (205, 214) is fixed to the lateral walls of the preparation chamber (15) by means of spokes (305, 314) which are distributed appropriately within the round angle and which are partially hollow so that they can be used as channels for connecting the opposing pressure chambers of the said casing of the cylinder and piston units to external switch valves (405, 414).
- 15 16. Apparatus according to Claim 13, characterized in that the preparation chamber (15) is connected to means for the gravity feed of the product.
- 20 17. Apparatus according to Claim 13, characterized in that the preparation chamber (15) is connected to means for the suction feed of the product, this chamber being used as a settling cyclone, being provided in an intermediate position with a tangential channel (315) connected to the product and being provided with a hole in its cover (215) for connection to the suction imparted by a suction means (17) on whose outlet a filter (117) is placed.
- 25 18. Apparatus according to the preceding claims, characterized in that the hopper (1) comprises minimum level sensors (23) and if necessary maximum level sensors (24), which are connected, together with the level sensor (16) of the preparation chamber (15), to a processor (25), which controls the automatic operation of all the valves (405, 414, 19, 20) of the said apparatus, and which receives the signals relating to the internal pressures of the hopper and of the compensation chamber through suitable interfaces and instruments (70, 21, 121), the said processor being 30 connected to a programming and interrogation unit (26).

19. Apparatus according to Claim 18, characterized in that the processor (25) which controls the automatic operation of the said apparatus is provided with a program which keeps both valves (5, 14), for connecting the hopper (1) to the compensation chamber (13) and for connecting the latter to the preparation chamber (15), open when washing fluids are passed through the whole apparatus.

5 20. Apparatus according to one or more of the preceding claims, characterized in that the product hopper (1) is round in plan view and is formed by a lower bowl (201) which has a base (101) raised towards the centre and which is covered by a conical and upwardly converging cover, in such a way as to promote the flow of the product towards the perimeter of the base bowl of the said hopper, where the outlet apertures (8) are provided to feed the product to the dosing stations (D) of the compressing, capsule filling or dosing machine, this shape of the hopper also being helpful in ensuring full and uniform internal cleaning of the hopper during the cyclical washing and sterilization stages.

10 21. Apparatus according to one or more of the preceding claims, characterized in that the base (101) of the hopper (1) is provided axially with an aperture through which passes, with a seal, a shaft (11) which carries, on its end located inside the hopper, blades (12) which mix and slowly fluidize the product placed in the said hopper, means being provided to impart to the said shaft a slow rotary motion relative 20 to the said hopper.

22. Apparatus according to Claim 21, characterized in that the shaft (11) carrying the blades (12) for fluidizing the product in the hopper (1) can be axially hollow and can be used for sending compressed gas into the said hopper, as an alternative to or in combination with the aforesaid means (6).